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THE INCREASE OF THE FOOD SUPPLY FOR DUCKS IN NORTHERN ONTARIO.

In a previous pamphlet published by the Game and Fisheries Department of Ontario, entitled "The Possibilities of Northern Ontario as a Breeding Ground for Ducks," it was shown that there were probably 2,800,000 acres in the lakes and rivers of that territory on which edible water plants would grow. Since that time the district of Patricia, with a total area of about 150,000 square miles or six-sevenths the size of Northern Ontario as it existed before this addition, has been included. No definite information is available of the percentage of water-covered area in this district. From the maps published, the proportion covered by water probably is somewhere between that existing in the part east of Port Arthur and north and south of the height of land respectively, or from 2 to 10 per cent. On the basis explained in above mentioned pamphlet this would mean an addition of from 450,000 to over 2,000,000 acres available for the growth of edible water plants. In any case it must constitute a most important increase to the duck breeding possibilities.

As the idea is to propagate plants which furnish food for ducks not only in the fall but throughout the entire season during which the waters are open, we are confined to plants which have a continuous growth, and have parts other than the seed which are edible. In the following descriptions and illustrations only some of the important ones are dealt with, others might form matter for further investigation and description at a later time. As it was desirable to have the aid of a skilled botanist, Mr. R. B. Thomson, Associate Professor of Botany, in the University of Toronto, was asked to collect and illustrate the plants in question. The specimens were taken from Whitewater Lake, near Sudbury, about the middle of September last year.

Of the plants described wild celery (*Vallisneria spiralis*) is perhaps the most important, as it provides food at all times of the year, the roots being available always, while the leaves are edible in the early part of the season and the seed pod forms a favorite morsel in the fall. In addition to this it is probably able to grow in a greater depth of water than the other edible plants and consequently can thrive over a greater area. To grow in ten feet depth is nothing unusual for the wild celery, and it will thrive in water as shallow as three feet. The means it has of propagating itself are moreover very efficient—both by seed and sending out suckers—so that it is in all ways a most desirable plant to introduce. All the varieties described here are indigenous in Northern Ontario except the wild celery.

Experiment with Wild Celery in Northern Ontario.

That this plant will readily grow in Northern Ontario can be seen by the results in above mentioned lake. The first attempt to cultivate wild celery in this water was in 1909 when about half a bushel of pods was obtained from Lake Erie and some plants from Lake Ontario. The method used in planting was to wrap the pods in balls made of clay and drop them in water of the proper depth, viz: about four feet. The following year about two bushels of pods were introduced, and in 1911 about three bushels. By 1912 the wild celery had spread in a surprising manner. In many cases it was found half a mile or more from where any

seed had been planted, no doubt it was drifted by the wind. In some places thick patches or beds had formed, the largest possibly being about an acre in extent. Then there were numerous smaller patches covering several hundred square feet each and a vast number of single plants or small groups. According to the writer's estimate the total area that would be thickly covered by the wild celery, if it could be all put together, would be about ten acres. This rapid increase was in spite of the continuous ravages of the ducks. One mistake was made in planting the seed which could be avoided another time. The great influence of the wind was not taken into account. The seed was all put towards the east end of the lake; the prevailing winds being westerly, it was found that there was a general drift towards the east (although the natural water flow was westerly) some of the seed being driven on the shore before it had an opportunity of establishing itself. This general drift could be seen also in the shape of the beds or patches of wild celery, these were always long and narrow, the long side having an easterly trend. In a few years more the plant should be well started over all parts of the lake which are capable of growing it. This would amount to about 1/2000 of the total estimated area in the Province, as it was before the addition of Patricia, available as duck-feeding ground. It does not seem, therefore, such a serious task to render productive a considerable percentage of the possible area on which plants suitable for duck feed will thrive.

In 1912 a certain amount of wild celery was procured from Lake Erie by the Game and Fisheries Department of Ontario and sent to various persons interested in the question. Unfortunately it was not possible to procure much seed as owing to the cold season it was several weeks late in maturing and at the proper time for picking there were continuous high winds making it impossible to gather the seed. After ripening the seed remains near the surface only about two weeks and then falls to the bottom where it is impossible to pick it.

Various Plants Useful for Food.

The floating pondweed (*Potamogeton natans*) is an important source of food, as it is so widespread, growing not only in lakes but also in rivers and creeks. In these it forms a most valuable food. A full description is given below. The leaves, which float on the surface, are coarse and wiry in appearance and the writer has never seen any evidence of the leaves being eaten by ducks. Only the seed appears to be edible. This ripens in September, and in the creeks is a welcome food for the marsh duck, while in the lakes it also helps to support the deep water feeders. It will grow in water up to six feet in depth and it is important because it grows in so many places in Northern Ontario; in some lakes and streams indeed, where feed is scarce it seems to be the only article of diet. This plant furnishes food in September chiefly. With many of the other members of the Potamogeton family the seed ripens later.

Another member of the same family is the *Potamogeton heterophyllus*, also illustrated. It grows entirely under the surface of the water, the leaves and also the seed being edible. The larger roundish leaves are easily mistaken for the *Potamogeton natans*, but are submerged instead of floating. The seed ripens in October and the plant grows in water 3 to 6 feet deep.

Potamogeton perfoliatus is probably the most important member of this family growing in Northern Ontario at the present time, owing to the fact that it thrives in so many places and will grow in a greater depth of water than the others. It is found also on the shoals in Lake Ontario where the ducks feed in the winter

and thus makes it possible for a number of them to avoid migrating. For these reasons it must be considered one of our most important duck plants. This Potamogeton, which grows entirely submerged and in water up to 8 feet in depth furnishes an edible leaf besides the seed which ripens in October. The leaf with this plant is much more important than the seed. These various Potamogetons in addition to animal food form the principal diet of the deep water ducks in Northern Ontario at the present time.

Food for Marsh Ducks.

As explained in above mentioned pamphlet probably more can be done to increase the number of the deep water feeders than of the marsh duck, as the area available for growth of edible deep water plants is much greater in Northern Ontario than it is for the ones on which the marsh duck feed. If anything substantial is to be done in increasing the number of ducks breeding in the North, the wild rice illusion must be destroyed. The common belief is that if only wild rice could be grown there would be plenty of ducks. Wild rice does not support the ducks *while they are breeding.* It merely attracts those that have bred and fed elsewhere to the rice beds when the seed is ripe, very often to their destruction. That it will sometimes thrive in Northern Ontario can be seen by the growth in Rice Lake north of Biscotasing, Summit Lake north of Nipigon, and Shoal Lake near Kenora. Even if it grew everywhere it would only furnish food for possibly a month or so out of the seven which the ducks spend in the north each season. Moreover, as it is only an annual and is propagated solely by seed which is extremely delicate and loses its fertility easily, efforts to transplant it will not on the whole be accompanied by much success. The writer has on a number of occasions planted wild rice, taking every precaution to have the seed in proper condition, but the results have never been worth the trouble; at the best after several years there would be a few miserable scattered tufts of wild rice showing here and there.

As something greatly superior to wild rice, because it supplies food from the spring to the fall, and has an extraordinarily rapid rate of increase and is easily transplanted and is even transported by the ducks themselves, the writer recommends plants of the Lemna family. Large numbers of black duck have been observed where this was almost the sole food. This plant, which is described by Mr. Thomson looks like tiny clover leaves growing on the surface of the water; at a distance it would be mistaken for a green scum. As the tiny rootlets which it sends out are only about an inch long, there is nothing to fasten it to the bottom, and hence it would be swept away if exposed to wind or surrent. Protected pools in marshes and drowned lands are the only practical places for this plant. Drowned lands with water-killed trees are particularly favorable. These will be formed almost always where there is a water power developed with a proper storage reservoir. Usually such lands will be a square mile or more in extent. The maintenance of constant water levels so desirable for water powers is beneficial to the duck plants. The violent fluctuations of these levels caused in lumbering operations are very destructive of aquatic plant life.

The plant illustrated is the *Lemna minor; Lemna polyrhiza* is similar to this but larger and having more rootlets. These two species as they grow on the surface of the water can be transplanted by taking sphagnum moss which may be obtained from flower and seed dealers and skimming the surface of the water with pieces of moss of convenient size. The Lemna sticks to the moss which acts like a

sponge in taking up and retaining moisture. These balls of moss with adhering Lemna should be sent to where they are to be planted as quickly as possible. If they are kept well moistened and have free access of air the plants will keep for some days. The balls of sphagnum can then be thrown on the surface of the stagnant water where it is desired to plant the Lemna. In this way some Lemna taken from Grenadier Pond near Toronto was sent by the writer about the end of May last year and planted on drowned lands near Sudbury. By September the plant had spread well, some of it being found half a mile up stream from where it had been scattered. As the plant floats on the surface of the water and is not anchored in any way, it is easy to see that some of the leaves are likely to stick to the bird when a duck swims in among a bed of this and greedily feeds. When it flies off and alights in the water elsewhere the plant will be detached, and owing to its efficient method of propagation explained further on will become the nucleus of a new growth. There is no reason why all drowned lands should not be made productive of ducks by introducing this plant.

Another member of this same family is *Lemna trisulca,* also illustrated. This plant grows wholly submerged; from its peculiar lattice work structure, it might readily be entangled in a duck's feet and transported. It has a rapid growth and is tender and lasts throughout the season. This submerged form is of minor importance to the floating ones.

Food Found in Ducks.

In order to ascertain definitely the relative importance of different kinds of food for the different varieties of duck, it is necessary to open and examine a number of birds. The duck's feeding organs are simple and efficient. A tube leads direct from the mouth to the gizzard, which is lined with a very tough skin and surrounded by powerful muscles, and contains fine gravel and coarse sand. As soon as any food enters the gizzard, the muscles start working and the food is quickly cut up between the sand and gravel. For this reason any tender thing such as leaves of any kind or soft animal tissue quickly becomes an unrecognizable mass for the ordinary observer and requires an expert botanist and zoologist to identify it. To settle more particularly the relative importance of the different kinds of food, the contents of a number of gizzards of birds killed during the latter part of October on Whitewater Lake were sent by the writer to Mr. Thomson for examination. His results appear below and are worth careful study. Four different varieties of ducks were sent, all of them being deep water feeders. Two of these varieties, the Bluebill and Buffle Head, were shown to be almost exclusively vegetable feeders, while the Whistle Wing or American Golden Eye showed more plant than animal food. Of the vegetable matter, the wild celery was most important in two and second in one. *Potamogeton heterophyllus* appeared in all more or less and evidently is a plant worth cultivating. As explained by Mr. Thomson, at that time of the year, the leaves would not naturally be so important as food and hence the *Potamogeton perfoliatus* which is valuable mainly for the leaf would not make such a favorable showing. It will be noticed that the seed of the Myriophyllum was an important constituent of the Bluebill's food. The writer could not recommend propagating this plant, however, as he has never found that the ducks eat the leaves and the seeds are only few in number on each plant. It is such a rank grower, moreover, that it would probably choke out more useful plants. In considering the importance of the different plants mentioned as shown by the preference exercised by the ducks, account must be taken of the

relative amount of each present in the waters where the birds had been feeding. When this is done the wild celery appears as much the most important. As explained above the celery would cover possibly ten acres, the Myriophyllum would certainly cover over 600 and the *Potamogeton heterophyllus* probably 100-200 acres; that is, although there was sixty times as much Myriophyllum and ten to twenty times as much of the Potamogeton neither on the whole formed such an important article of food.

Two of the varieties, viz: the Whistler and the Hooded Merganser contained substantial quantities of animal food, but there was absolutely no fish in the seven Whistlers examined and only an insignificent amount of fish in the five Mergansers. This was not because they were not obtainable, as the waters where these ducks were killed are teeming with small fish. The writer has on previous occasions examined the gizzards of many Whistlers and Hooded Mergansers without finding fish, although fish remains would be easily recognizable. In the Report of Ontario Game and Fish Commission, 1892, (p. 331), in describing the Whistler this appears: "It feeds on fish, shellfish, molluscs, marine vegetables and seeds. Its flesh is consequently fishy and almost unfit for food." This Report ignores the Hooded Merganser, and states that at the Buffle Head's flesh is fishy and that its food consists of small fish. All these birds, the gizzards of which were examined were in fine condition and of excellent flavor. No doubt they will take fish if they cannot find anything else they like better, as we would eat hard-tack if we could not get bread.

The food of the small Merganser was shown to be almost exclusively animal, but it was insects, not fish. Both the Whistler and the Hooded Merganser are important for Northern Ontario as they are probably the most usual and widespread varieties there now. Their taste for animal diet should give them an advantage in the quest for food. They are certainly well worth propagating.

Importance of Variety in Food.

The fact that human beings crave for variety in food and that the system revolts against a diet of any single thing is known to everyone. Domestic fowl show the same taste. If the liking for variety has anything to do with the intelligence, then the duck should show it more than other birds. It is impossible to study the *detailed* analyses of each of the thirty gizzards given by Mr. Thomson (not published) and come to any other conclusion. Of this number only two had been feeding on one thing exclusively, in both cases Vallisneria seed. Of the eighteen Bluebills and Buffle Heads all but one contained some *Potamogeton heterophyllus* seed, several gizzards were more than half filled with this material, but none of them contained that alone, although any one of these birds could have easily found enough of this seed to form its sole diet. In addition to this the different plants offer their most attractive food at different times of the year; probably, also, in some seasons the growth of certain of the varieties would be more or less a failure. Those interested should therefore try to offer a variety of food for the ducks. From the descriptions and illustrations anyone can identify the various plants and transfer them from one lake to another according to directions given and put them in a suitable depth of water. With the introduction of wild celery and any other deep water plants which may be found suitable to the northern lakes, the number of the deep water feeders will be increased. As shown before, these varieties are the most suitable for the north. A widespread planting of members of the Lemna family in suitable places would improve the means of supporting marsh ducks.

DETAILED DESCRIPTION OF PLANTS BY R. B. THOMSON.

As mentioned above I visited Whitewater Lake, near Sudbury, in the latter part of September, 1912, to study the plant food which the Northern lakes afford for ducks and collect specimens for illustration. With the exceptions noted under the figures, all the specimens shown are from Whitewater Lake.

In considering plants as food material it must be recognized that at one season of the year one part of a plant may contain a greater proportion of the food material than at another. For instance, a perennial withdraws its food material from the leaves in the autumn, and stores it in the stem or roots. Again, in the formation of the fruit much of the reserve of food finds its way into this region, the seed usually being packed with starch and other food materials.

Description of Plants.

As a plant that is an important food for deep water ducks all through the season, first place must be given to the form so successfully introduced into Whitewater Lake, the so-called Wild Celery of duck hunters, illustrated in Fig. 1.

This plant (*Vallisneria spiralis*) is known by several other common names, Tape-grass, Eel-grass, etc. It is a submerged aquatic plant with long grass-like leaves about a half-inch wide and from a foot to a foot and a half in length. These leaves have three rather distinct veins running from the base to the tip, and here and there some transverse ones, which, no doubt, are responsible for the name Tape-grass, which is most frequently applied to the plant. These leaves all come from a very short stem, just as in the ordinary celery of the garden, with which, however, the plant has no botanical relationship, the whiteness of the leaves at their base and their crispness having, no doubt, given rise to the name wild celery. The roots of the plant are attached in a great bunch (see Fig.) just below the crown, from which the leaves come off. Their fibres penetrate the loose mud or sand at the bottom of the still water where this plant thrives.

Vallisneria has two very efficient methods of propagation. Runners (see Fig.) come from these plants in numbers, and from these a series of young plants arise. I have found five on one runner in a specimen from Whitewater Lake, though the one figured has but two attached to it. Just as in the strawberry, these young plants are smaller the farther they are from the mother plant. Their leaves are very crisp and delicate and form a valuable food for the ducks.

The plant is propagated by seed also. About the middle of August a long thread comes to the surface bearing the minute white flowers at the apex. One plant (the male) produces only pollen-bearing flowers, which will form no seed, while another plant has flowers which will bear the seed if they have been fertilized by the pollen from the other plant. The male flower usually breaks away from its anchoring thread and floats around among the female flowers, setting free its masses of pollen on the surface of the water. This reaches the female flower and fertilizes it, after which seed sets in the female flower and the male disorganizes. In most plants the pollen is carried by the wind or insects, but in the case of Vallisneria the pollen floats on the water from the one flower to the other. About the middle of September the thread supporting the female flower begins to coil into a loose spiral (from which the plant derives its scientific name) and the seed pod is drawn down from the surface. At this time of year the pod is usually about 2-3 inches in length and full of a jelly-like substance in which are incased the host of yellowish immature seeds. By October the pods have become 3 to 5 inches in length and very

much thicker. The seed is then dark brown in color and is mature. The pods sink still deeper in the water and finally disorganize, setting free the seed which is drifted from place to place to establish fresh colonies of the plant. The mature seed is packed with starch and very nutritious, as is also the pod itself.

The double method of propagation of this plant enables it to establish itself very rapidly and practically ensures its permanence once it is planted in a given region.

The Potamogetons, or Pond-weeds, as they are commonly called, sometimes grow completely submerged like the wild celery, but usually some of the leaves come very near the surface or may even float on the water. They all have a long slender stem by which they are attached to the bottom; this stem may be leafy or devoid of leaves.

In the so-called Floating Pond-weed (*Potamogeton natans*), illustrated in Fig. 2, the lower leaves on the stem are very much reduced in size, while the upper ones are large and floating. They have usually a heart-shaped base where they join the leaf stalk. This stalk, too, is attached in a peculiar way to the blade—looks as if it were jointed. It usually bends slightly to one side instead of coming straight from the base of the leaf. Where the leaf stalk is attached to the stem there is a structure (a stipule) like a grass leaf, which in the autumn is much frayed into long colorless threads. The seed ripens in September, but persists for a long time in the fruiting head. This is from one to two inches in length, and since usually most of the seeds in a head mature and each seed has a good store of starch in it, the plant affords valuable food.

Floating Pond-weed can be propagated by seed. If the seed is found to float when collected, it can be embedded in balls of clay and will then sink when thrown into the water at the desired places.

Figure 3 is of the Various-leaved Pond-weed (*Potamogeton heterophyllus*). In this form there are two very distinct types of leaves. The upper ones are more or less oval in outline. They terminate in a little tooth-like projection. These leaves, though ordinarily called floating leaves, do not usually rest on the surface of the water but are slightly submerged. The lower submerged leaves are about the same length but much narrower and contracted at the base into a short stalk (see Fig. 3.) In some plants there are none of the upper type of leaves present, the whole of the leaves being of the type of the lower ones. Such plants are found growing along with the others. The stem is very slender, somewhat flattened, and usually much branched below. The stalk of the fruiting head is much thicker than the stem or other branches. The fruit and seed of this form are not more than half the size of those of the Floating Pond-weed described above. It ripens its seed in September and October. In should be propagated in the same way as *Potamogeton natans*.

The Clasping-leaved Pond-weed (*Potamogeton perfoliatus*) never has any floating leaves. There is, however, considerable variation in the shape and size of the leaves which occur very abundantly on the much-branched stem. In all cases the leaf has a heart-shaped base, which embraces the stem. Usually it terminates in a long slender point (see Fig. 4). The leaf, too, is always more or less crinkled.

This plant has a very effective method of propagation, aside from reproduction by seed. As it grows the older parts die away and the young branches, with their smaller leaves, can float away and form new plants. This is especially true of the plant during the winter. No old stems and leaves survive, and in the early spring only the small-leaved type, Fig. 4a, is to be found. Towards the autumn, however, the long-leaved forms are abundant. These long leaves, however, are attached

to the older part of the stem and not to the smaller branches, which are always clothed with leaves like those in Fig. 4a. The contrast between the two types of leaves is shown in Fig. 4b, drawn by Mr. Graham from a specimen from White-water Lake.

The fruiting branch of this form has a very short stalk, and its fruit is the smallest of the three described. The food value of this plant lies in its leaves chiefly. Its ease of propagation makes it very valuable.

There is a valuable Old Country Pond-weed which has been introduced into our older settled parts and which should be as valuable or even more valuable than the Clasping-leaved form above described. It thrives in the vicinity of Toronto and has been found to be an important food for ducks wintering in the open lake near Toronto. It would, no doubt, do well in the north, and since it has a very rapid method of propagation by means of buds, would be very easily established. The leaves of this form (*Potamogeton crispus*) are crinkled and very crisp, like those of the Clasping-leaved form. They are quite long but much narrower than those of the latter.

The two forms illustrated in Fig. 5, a and b, are Lemnas, and belong to the group of plants known as the Duck-weed family. They are the smallest and simplest of all the flowering plants, one form belonging to the family being not much larger than a pin-head. They thrive on the water of stagnant ponds and on muddy banks. The one illustrated in Fig. 5a is a common form. The plant consists of a single leaf-like roundish disc less than a quarter of an inch in diameter, from the centre of the under surface of which a single root hangs down into the water or penetrates the muddy bank. When fully grown three rather indistinct veins can be seen coming from a point a little behind the centre of the disc. From this spot, too, the root arises, and, what is more important, from this same spot the new plants spring, and from these again other smaller ones. The parents and offspring remain attached until a little colony of half a dozen or so is formed, and then they separate to form new groups again. They propagate very rapidly by their budding process during the summer. Towards autumn they form little bulblets which sink to the bottom during the winter and in spring come to the top and start the summer form growing again. The plant also propagates itself by seeds, but these are not either numerous or important.

The plant represented in Fig. 5b is a submerged form which, though not so important as the other, propagates in the same way. The plants when young have a very short connecting thread. This does not, however, remain short, as in the former, but elongates and thickens as well, holding the plants together for considerable time, thus producing chains or networks of rather complicated form. Two groups of these are shown in Fig. 5b. The body of the floating form (Fig. 5a) is rather thick and has a large amount of nutriment in it, while the submerged one (Fig. 5b) is much thinner and has much less food material in it.

Gizzard Analyses

Towards the end of October Mr. Mickle sent me the gizzard contents of thirty ducks, and from these some important information was obtained.

In analysing the contents of each gizzard an attempt was made to estimate the proportion of plant and animal food, and then of the various constituents of each. The whole content was put at 10, and the various parts estimated as fractions of this. Of course, it is recognized that the individual results are subject to error, but on averaging these the final result is an approximation, and serves to give

an idea of the relative importance of the various constituents of the food of the ducks in this region at this season of the year. A summary of the results for the different groups of ducks is given below. The percentage of animal food is bulked, except in the case of the Mergansers.

ESTIMATED PERCENTAGE OF THE VARIOUS CONSTITUENTS OF DUCK FOOD

	10 Blue-bills Oct. 22-26, 1912	8 Buffle-heads Oct. 20-28, 1912	7 Whistlers Oct. 20-26, 1912
Vallisneria, seed, root and leaf	27%	52%	50%
Myriophyllum, seed	31 "	6 "	3 "
Potamogeton heterophyllus, seed	18 "	33 "	4 "
P. perfoliatus, leaf, etc	16 "	0 "	0 "
Miscellaneous seeds	3 "	1 "	0 "
Total plant	95%	92%	57%
Total animal	5 "	7 "	43 "

	5 Mergansers Oct 22-30, 1912	
Dragon-fly nymphs	62%	100%
Caddis-fly larvae	24 "	
Crawfish	12 "	
Fish	2 "	
Vallisneria seed		1%

Of the gizzards of the Blue-bills, only one contained any animal food. This consisted of several dragon fly nymphs and a caddis fly larva. The most important plant seeds were those of the water mill foil (Myriophyllum) and of the wild celery (Vallisneria). Potamogeton seeds were also found in considerable amounts. In several there were the recognizable remains of leaves of various water plants, Potamogetons and wild celery. This part of the Blue-bills' food is probably much more important than appears to be the case on first sight, because the leaves of the plants are crisp and delicate and would soon be destroyed in the gizzard.

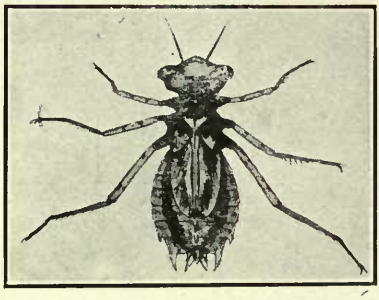
Of the eight Buffle-heads, only one had any animal food—two dragon fly nymphs and a water beetle and small fish. Of the plant food the seed of Vallisneria was found in all and formed the most important content of the gizzard. There was also a considerable amount of different Potamogeton seeds. In one instance the Potamogeton seed was the most important food.

The contents of one Whistler's gizzard consisted entirely of plant material and in one only animal food was found. The seed of the wild celery was by far the most abundant plant food, though small amounts of Potamogeton and Myriophyllum seed were found. Of animal food material the dragon fly nymphs were most important. Caddis fly larvæ and water bugs and beetles were also found.

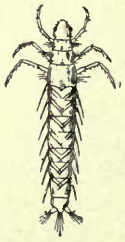
In only one of the five Mergansers was there a trace of vegetable food—a few seeds of Vallisneria—and some traces of leaves, probably of the same plant. Animal food was present in abundance. In all there were found dragon fly nymphs (larvæ) and caddis fly larvæ, the dragon fly larvæ, however, being much the more important. In one gizzard a cray fish was found over 3 inches in length. In the same gizzard there were also the scales and other remains of an ordinary fish—a minnow (?) 2-3 inches long.

Mr. W. A. Clemens, B.A., of the Department of Biology, kindly indentified the animal remains in the gizzards and gave me the information on the habits of the

two forms figured below, which constituted the most important part of the animal food of the ducks examined.



Text Fig. A. Dragon Fly (Devil's Darning Needle) Nymph, after Needam, natural size. This larval form remains in the water, living about two years on other aquatic life before emerging into its commonly known adult winged form. Abundant in streams and ponds and in the bays of larger bodies of water.



Text Fig. B. Caddis Fly larva. After Furneaux, natural size. This form lives a year or two with its body encased in a tube constructed of sticks, pebbles, shells, grass, etc. After emerging and attaining its mature winged form it lives a short life, flying along the shores, mating, laying eggs, and then disappearing. It is widely distributed and abundant, like the Dragon Fly nymph.

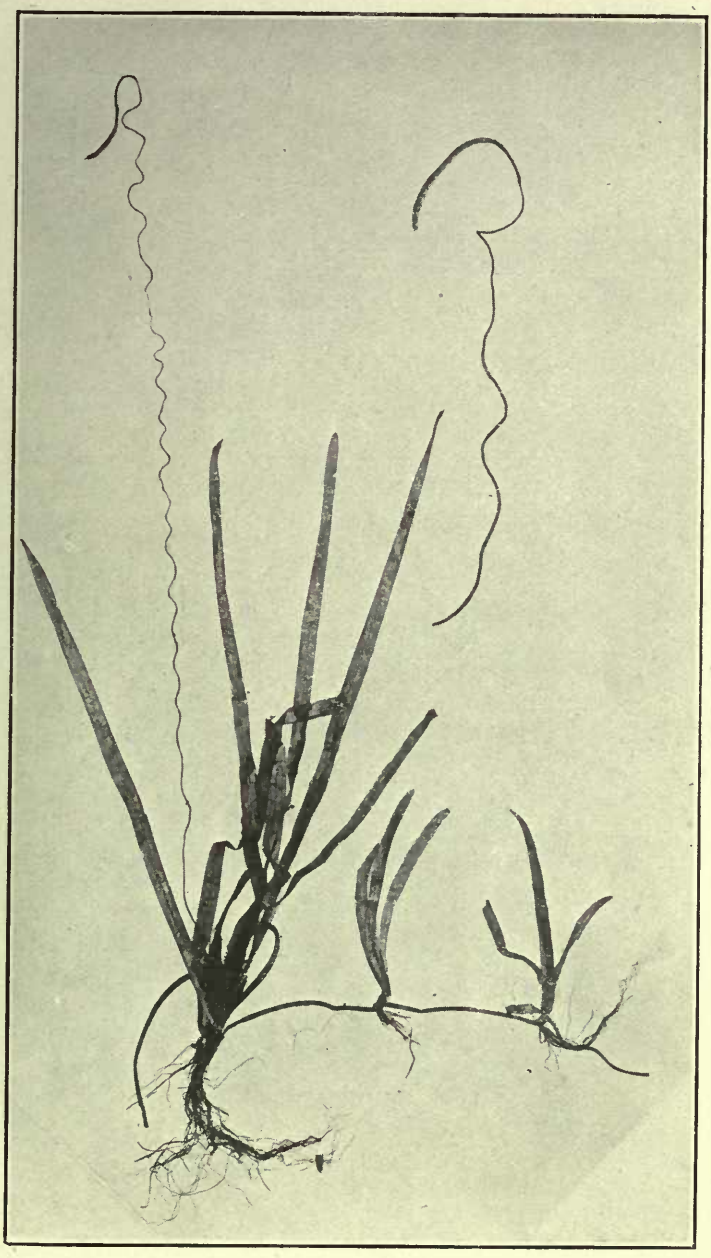


Fig. 1. *Vallisneria spiralis.* Reduced to one-third of the natural size. To the right, a runner with two young plants on it. There were two other runners with plants attached, which have not been photographed.

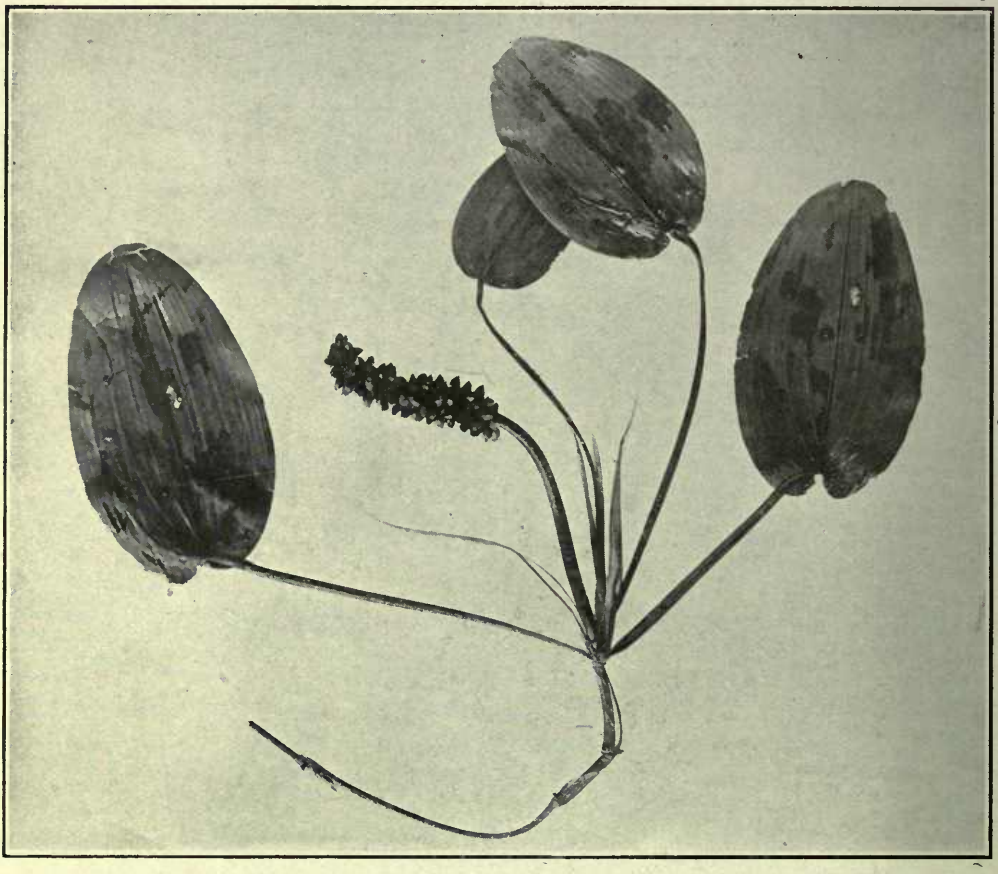


Fig. 2. *Potamogeton natans*, Floating Pond-weed. Reduced to about one-half natural size.

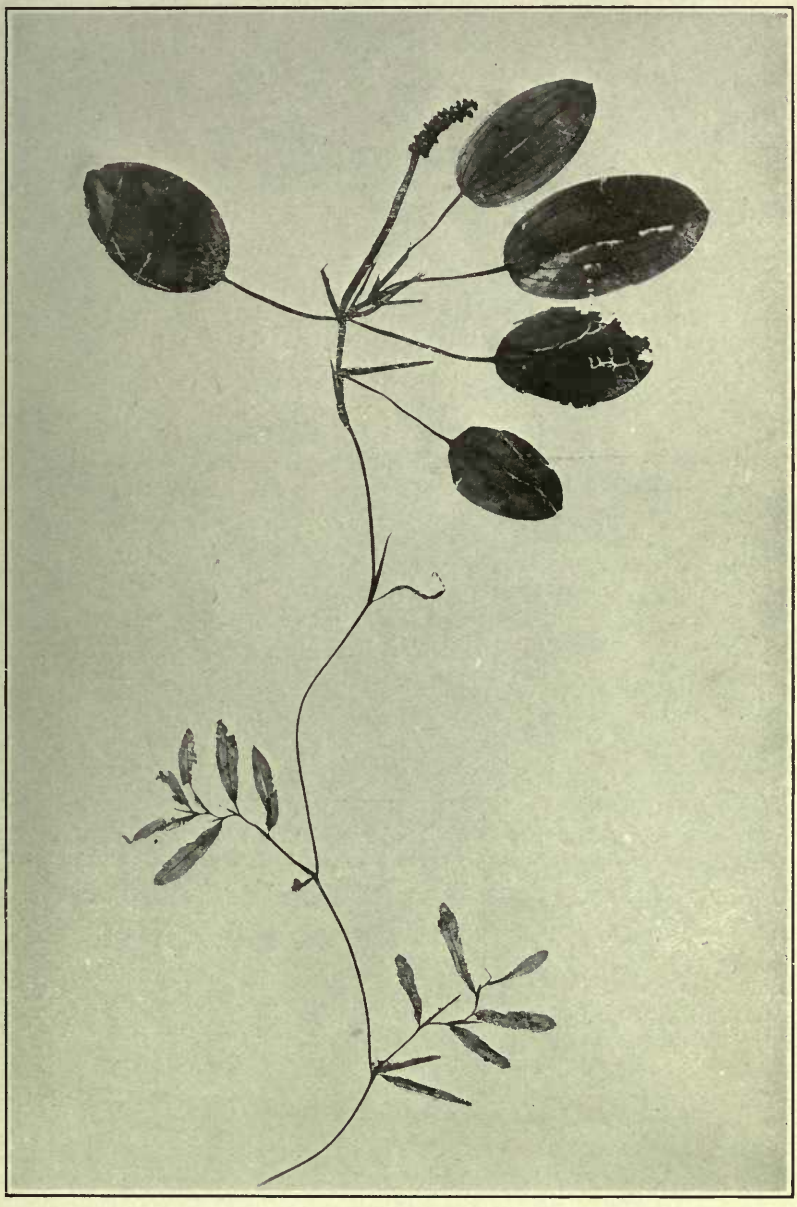


Fig. 3. *Potamogeton heterophyllus*, Various-leaved Pond-weed. Reduced to about one-half natural size. The imperfect leaves are characteristic at this time of year.

Fig. 4*a*. *Potamogeton perfoliatus*, Clasping-leaved Pond-weed. Collected by Mr. G. H. Graham in a pond near Toronto, June 25, 1908. Reduced to about one-third natural size.

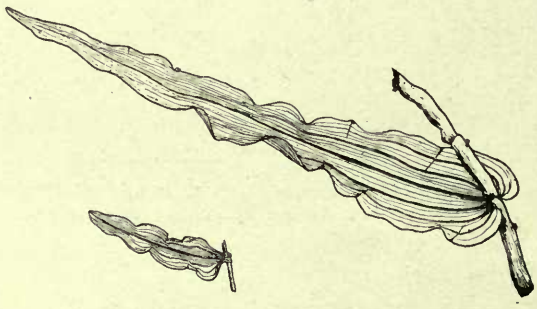


Fig. 4*b*. Two leaves, one-half natural size, of a plant from Whitewater Lake, showing the clasping base and the variation in size. Drawn by Mr. G. H. Graham.

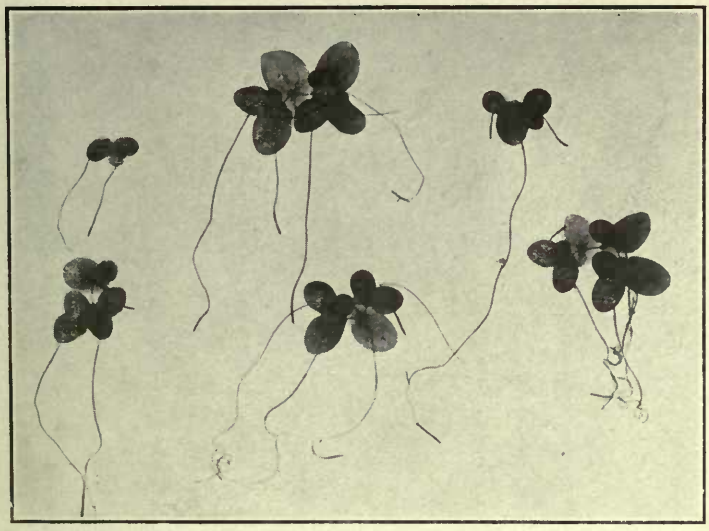


Fig. 5*a*. *Lemna minor*, from Grenadier pond.

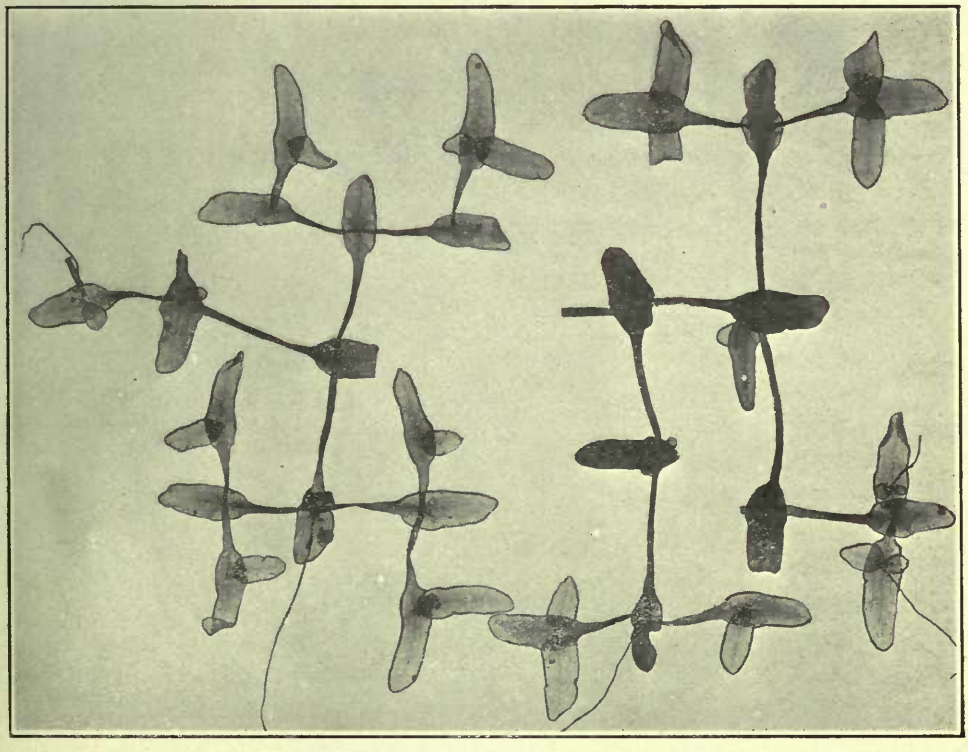


Fig. 5*b*. *Lemna trisulca*. About twice the natural size.